Assessing collective defensive performances in football: A Qualitative Comparative Analysis of Swiss central backs

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Abstract

Ahead of the World Cup in Brazil the crucial question for the Swiss national coach is the nomination of the starting eleven central back pair. A fuzzy set Qualitative Comparative Analysis assesses the defensive performances of different Swiss central back pairs during the World Cup campaign (2011 – 2014). This analysis advises Ottmar Hitzfeld to nominate Steve von Bergen and Johan Djourou as the starting eleven central back pair. The alternative with a substantially weaker empirical validity would be Johan Djourou together with Phillippe Sendeos. Furthermore, this paper aims to be a step forward in mainstream football analytics. It analyses the undervalued and understudied defense (Anderson and Sally 2012, Statsbomb 2013) by explaining collective defensive performances instead of assessments of individual player or team performances. However, a qualitatively (better defensive metrics) and quantitatively (more games) improved and extended data set would allow for a more sophisticated analysis of collective defensive performances.

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Introduction

During the World Cup campaign, the Swiss national coach Ottmar Hitzfeld trusted the 4-2-3-1 tactical system with a fixed set of starters on most positions. Only four positions are really contested before the FIFA World Cup in Brazil. The only striker position, since the most nominated option Haris Serferovic only sparsely play in his club and the newcomers Josip Drmic, Admir Mehmedi and Mario Gavranovic lack international experience. On the left midfield position Tranquillo Barnetta and Valentin Stocker have been competing more or less on the same level. The most complex decision for Ottmar Hitzfeld is the nomination of the two central back (CB) positions. The 4-2-3-1 tactical system requires a central back pair (CBP). The CBP is crucial for the stability of the whole team. During the Brazil campaign, Ottmar Hitzfeld had to change several times his CBP due to injury, suspensions or lack of game time of his CB in their clubs. Ottmar Hitzfeld nominated Steve von Bergen (Young Boys Bern), Fabian Schär (FC Basel), Johan Djourou (Hamburger SV) and Phillippe Senderos (FC Valencia) is his 23-players squad. In an event of a serious injury, the replacement would be Timm Klose (VFL Wolfsburg).

One month before the first game on 15 June 2014 against Ecuador the CBP is still a weak spot. Steve von Bergen is showing mediocre performances in his club but was strong in his national team appearances. Fabian Schär is without a doubt an upcoming talent but is too fragile for defensive mistakes. The once considered Swiss CB dream team Djourou and Senderos are underperforming in their clubs and are constantly struggling with injuries. Thus, the purpose of this study is to find out which CBs were most successful during the last campaign and therefore which CBP is most promising to start for Switzerland in the World Cup.

Mainstream football analytics focus on the assessment of individual player or team performances (e.g. CIES Football Observatory 2013). "Most analysis still focuses on discrete variables and actions, but most important for us is to understand the interactions" explains Pedro Marques a football analytic from Manchester City (Wired 2014). As a potential step forward, Qualitative Comparative Analysis (QCA) studies social phenomena that occur together (Ragin 1987) which enables me to assess the collective performance of CBPs. QCA assesses conjectural causalities, means in the context of this paper that the causal role of a single defender in explaining a good defensive performance may unfold only in combination with other defenders. By employing a fuzzy set Qualitative Comparative Analysis (fsQCA) which studies the interrelated performance of players, this paper aims to go one step further than conventional sport analytics. Furthermore, this paper tries to shed light on another understudied aspect of football analytics. Christopher Anderson, the author of "The Numbers Game", points out that "[t]here's a huge inefficiency in the market of understanding and evaluating the defensive performance of players" (CNN 2013).

If we consider that scoring a goal, on average, is worth slightly more than one point, whereas not conceding a goal produces, on average, 2.5 points per match (Anderson and Sally 2013, 130), finding ways to measure the collective defensive performances becomes even more crucial.

Method

QCA is one of the most influential recent innovations in the Social Sciences (Thiem and Duşa 2013, 87). The spread of QCA mainly started by Ragin's (2000) introduction of fsQCA (Thiem and Duşa 2013, 87) which allows the incorporation of conditions[2] that vary by the level of degree (Ragin 2009, 87). For example, while is clear that zero goals conceded is an excellent defensive performances and 4 goals conceded is a poor defensive performance, there is a range of in-between cases. The QCA method is based on Boolean algebra. The basic idea is that if an outcome such as "0 goals" happened in a game with the two defenders *A* and *B* as well as in a game with with the two defenders *A* and *C*, it obviously does not make a difference for the occurrence "0 goals" whether *B* or *C* is present. It is the different constellation of conditions, or to put it differently, the causal complexity behind a given phenomenon, that are at the core interest in QCA strategies (Berg-Schlosser et al. 2008). One outcome can be caused by different constellations of conditions, which are all treated as equally important. The aim behind QCA is to identify regularities while remaining sensitive to cases and context (Ragin 1987).

Data and Measurement

I analyzed all Swiss national games since the start of the campaign for the world championship in Brazil[3]. The data set incorporates a total of 21 games (10 qualification games and 11 international friendlies). The five mentioned CBs share most of the game time in these 21 caps.[4] Translated in QCA language, the outcome is the defensive performance in games (PER/per). The conditions are the game time of the five CBs, namely, Steve von Bergen (VBE), Johan Djourou (DJO), Philippe Senderos (SEN), Fabian Schär(SCH) and Timm Klose (KLO), in the different national games. Table 1 reports the descriptive statistics of the five CBs. Five conditions in 21 cases are rather too few cases for a QCA (optimal would be $N \geq 2^C$). However, the case-condition ratio is well inside the rule of thumb for a sufficient value of cases ($N \geq Cx3$).

[2] In QCA language the term "condition" is used to describe a potential explaining factor. In regression analysis the equivalent would be the term "independent variable".

[3] The campaign started on 11 November 2011 with a friendly against Netherland and the last game was the friendly against Croatia on 5 March 2014.

[4] Also François Affolter (90 minutes), Fabian Lustenberger (45min), Gelson Fernandes (24 minutes) and Alain Nef (3 minutes) played for Switzerland between 2012 and 2014 on the CB position. However, all these players are excluded from the analysis because their game time was too trivial compared to the maximum 1890 minutes game time (21 games x 90 minutes).

Table 1: Descriptive statistics of center backs performances

Players (Condition)	Games played	Minutes played	Goals conceded	Minutes played per goal conceded
Von Bergen, Steve	17	1400	13	108
Djourou, Johan	14	1092	7	156
Senderos, Philippe	8	492	9	55
Schär, Fabian	5	362	5	72
Kose, Timm	6	301	2	151

Source: All data are obtained from transfermarkt.de
(http://www.transfermarkt.de/de/schweiz/spielplan/nationalmannschaft_3384.html)

Table 2 presents the calibrations of the outcome and the conditions. I used Ragin's (2008) direct method for the calibration of outcome and conditions values. The outcome "defensive performance" is measured by how many goals the Swiss national team conceded in a game. The CBs operating in the middle of the defensive line and are therefore the crucial pair of players in the defense. Given the lack of more sophisticated data, it is reasonable to use the defensive outcome of the game as a proxy for the defensive performance of the CBP. The data shows that Switzerland conceded between 0 and 4 goals in these 21 games. To have a clean sheet is the absolute aim of a CBP. Thus, I set the qualitative anchor for full set membership at 0.5. An analysis of ten year Premier League football highlights that if you concede one goal the chance is about 25% that you will lose the game. The second goal you let in is really the most decisive. If you concede two goals the chance to lose is already on 60% (Anderson and Sally 2012, 107). Therefore, a game with one goal against the team should be treated as a rather good defensive performance than a bad defensive performance. If the team conceded two goals than it is very hard to obtain a draw or a win, so this is a rather bad defensive performance than a good defensive performance. Given this reflections on the football game, I set the crossover point at 1.5[5]. I set the qualitative anchor for the full nonmembership at 3.5 because to receive more than 3 goals is exceptional in football and clearly stands for a poor defensive performance.

I can calibrate all five conditions identically. Here the qualitative anchors are rather straightforward. 90 minutes stands for a full set membership, 45 minutes as the crossover point and 0 minutes as full nonmembership. I am aware that if one player played half of a game he has exactly 45 minutes game time. To avoid this ambiguity, I assigned every player that just played half of the game with 46 minutes game time. It makes empirical sense because almost every half is followed by stoppage time. Thus, a player that played just one half is more likely to have played

[5] I am aware that the crossover point does not reflect the center of the conceded goal scale in my data but in order to avoid ambiguity, I decided to treat two goals conceded as a rather bad than a good defensive performance.

46 minutes than 45 minutes. Consequentially, a player that played the whole game has 92 minutes game time in my data set.

Table 2: Measurement and calibration of outcome and conditions

	Calibration threshold		
	Fully in	**Crossover Point**	**Fully out**
Outcome: Performance of CBs (=Goals concede)	0.5 Great performance	1.5 Neither good nor bad performance	3.5 poor performance
Conditions: Players (=Many minutes played)	90 "Fully in"	45 Neither fully in nor fully out	0 "Full out"

Source: All data are obtained from transfermarkt.de (http://www.transfermarkt.de/de/schweiz/spielplan/nationalmannschaft_3384.html)

Results[6] and discussion

The assessment of necessary conditions (see table 5 in the annex) reported that no player is a necessary condition for either a good defensive performance or a bad defensive performance. This is no surprise since the unpredictability of the game, especially on the international level, forecloses that one player could account always for a good or bad outcome. The analysis of sufficient conditions will offer a more nuanced picture of the collective defensive performance.

In the analysis I exclude truth table rows from the minimization process that contradicts the statements of necessity or sufficiency. When stating the results I rely on the intermediate solution. A suggestion of any directional expectations would be misleading. In professional football, especially on the international level, every player can contribute to a good defensive performance or bad defensive performance. No analysis of a bad defensive performance will be made since the research question wants to find out which player should play in the starting line-up and not which player should stay on the bench. Similarly, the absent cases (lowercase e.g. vbe) in the solutions are not discussed since I am only interested in possible combinations of center backs that should be nominated.

[6] The analysis of the data has been computed with the help of the fsQCA 2.5 software.

Table 3: Analysis of sufficient conditions for the outcome "good defensive performance" (PER), no frequency cutoff

Solutions	**Single game coverage**	**Raw coverage**	**Unique coverage**	**Consistency**
VBE*DJO*sen*sch	Netherlands Away, **Croatia Away**, Slovenia Away, Albania Home, Norway Home, Island Away, Greece Away, Cyprus Away, Cyprus Home, **Croatia Home**	0.518	0.416	0.849
SEN*DJO*klo*sch*vbe	Romania Home, Slovenia Home	0.167	0.110	0.944
KLO*VBE*sen*sch	Luxembourg Away, Greece Away	0.161	0.059	0.992
KLO*DJO*sen*sch	Tunesia Away, Greece Away	0.144	0.042	0.991
SEN*KLO*SCH*vbe*djo	Brazil Home	0.089	0.031	0.956
SEN*SCH*VBE*klo*djo	**South Korea Away**	0.076	0.020	0.838
Solution consistency	0.872			
Solution coverage	0.780			

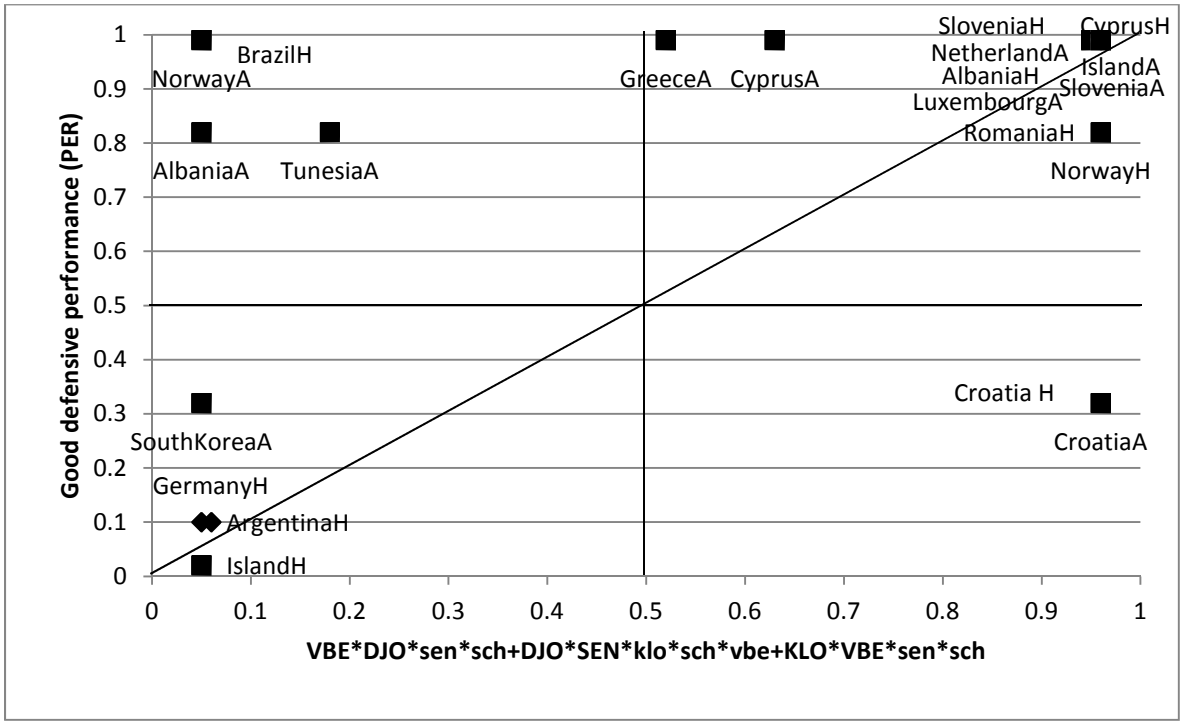
Notes: Games are ordered according to the game date, **contradictory cases (display the path but not the outcome) are bold.** The raw consistency threshold was set at 0.837. The next highest consistency score is 0.700. No frequency cutoff. Prime implicant is sch*sen.

The players that are sufficient for explaining a good defensive performance (PER) are presented in table 3. This analysis suggests that the CBP Steve von Bergen and Johan Djourou is a guarantor for a stable defense. This CBP can explain 51.8 % of all good defensive performances of Switzerland in the last two years. The other single solutions display a substantially weaker validity. The low values of the CBP Phillippe Senderos and Johan Djourou is due to their few joint appearances. They only played together as the Swiss CBP in two games in this data set. However, in these two games they defended solidly. They just conceded one goal in these two caps but display a mixed performance record (on win agains Slovenia and one lost against Romania). The CBP Timm Klose and Steve von Bergen played together only 30 minutes against Greece and 88 minutes against Luxembourg. They did not receive any goal in these 118 minutes. Both games, however, were friendlies what decrease the explanatory power of this single solution. The CBP Timm Klose and Johan Djourou is dropped from the analysis because the only time when this two defenders were together on the pitch was for 68 minutes in the away game against

Tunesia.[7] The last two single solutions are not discussed because they do not offer substantial coverage values. All in all, the result substantially highlight the good defensive performance of the CBP von Bergen*Djourou whereas there is no well-founded support for other CBPs.

After this discussion of the cases, only three single solution terms are considered as relevant in the context of this paper. Figure 1 display the explained cases of the three CBPs (VBE*DJO, SEN*DJO and KLO*VBE). The games in the top left corner are deviant cases that are not explained by my solution term, because the good defensive output was achieved by other CBPs. The only two contradictory case, actually directly contradictory to the most important single solution VBE*DJO, are the two caps against Croatia. To put it in perspective, the away game was a friendly and played in the very beginning of the campaign even before the kickoff of the first qualification match. Switzerland won the game with 4-2. This cases does not put forward convincing arguments against the CBP von Bergen*Djourou. A reason to worry is the home game against Croatia on 5 March 2014. It was the last international game of Switzerland and the CBP von Bergen*Djourou delivered a shaky defensive performance. It revealed that both players are lagging behind their performances that they showed during the Brazil qualification campaign.

Figure 1: Sufficient conditions for the outcome "good defensive performance" (PER)



First and foremost, this fsQCA analysis suggests that Switzerland should start with the CBP Steve von Bergen and Johan Djourou. When this CBP defended for Switzerland, six games ended with

[7] Table 3 suggest that the CBP Klose*Djourou as well covers the away game in Greece. In fact, Klose was substituted for Djourou after the break. Unfortunately my QCA design does not allow controlling for such incidents. However, it only occurs occasionally and mostly in friendly games.

a clean sheet, one game by one goal conceded and two games by two goals conceded. It is even more impressive if we consider that Switzerland won 5 games, drew 4 games and lost none of their games when this CBP played the whole game. However, the good defensive performances of von Bergen and Djourou were made in the beginning of the World Cup qualification and against rather weak teams compared to the World Cup level. In this early phase of the campaign both CBs had a period of consistent playing time in the club and they were injury free. Since both players are rather injury prone, it is helpful that the QCA suggest two other options for Ottmar Hitzfeld. However these two options display a weak coverage and therefore the support for the nomanion of these CBP stands on weak empirical grounds. Furthermore is Timm Klose not nominated for the 23 squad what leaves Ottmar Hitzfeld with only one alternative option. Johan Djourou and Philippe Senderos jointly appeared on the game sheet only in two caps what reaveals itself in the poor coverage score for this pair. However, these two CBs already played a lot of international games together and even played a substantial time for the same club (Arsenal).

Conclusion

Based on this fsQCA, I would advise Ottmar Hitzfeld to start with Steven von Bergen and Johan Djourou as CBs in the first game of the World Cup. The first alternative would be the pair Johan Djourou and Phillippe Senderso. Based on the QCA, it bears a smaller risk for Ottmar Hitzfeld to start with the CBP Johan Djourou and Philippe Senderos compared to other possible CBP combinations. However, the inherent randomness of football may make these insights obsolete. The situation of Djourou is far from optimal since he and his club are underperforming during this season. If we assume that Steve von Bergen is a fix starter, alternative partners would be Philippe Senderos and Fabian Schär. Both display weak defensive performances on the international level. Senderos conceded a goal every 55 minutes and Schär conceded a goal every 72 minutes. Senderos changed his club in January 2014 but he did not manage to increase his share of game time. It is questionable if he is in good shape this early summer. Even though the QCA suggest that he should play with Djourou, a CBP with Senderos and von Bergen is also promising. In the dataset they played one game together with a bad defensive performance of 3 goals conceded but with a very strong performance of the whole team. The friendly game ended in a 5-3 win against Germany which is a favorite for the World Cup title. Fabian Schär is a talented young CB. He already got some international experience in crucial games (e.g. Norway away and Albania away) and he scored three goals in total five national games which is a very impressive offensive output for a CB. However given the increased stress situations in a World Cup and his defensive mistakes are maybe a too big liability. This QCA reveals that it is not a

good option to start with the CBP von Bergen and Schär as some commentators suggest (e.g. Tages Anzeiger 2014).

The QCA offered some useful insights for assessing the defensive performance of CBPs. It is the assessment of collective performances of players while avoiding monocausality that makes QCA a fruitful extension to mainstream football analytics. If the cases in the dataset would be extend, even bigger parts of the team could be assessed (e.g. whole defense line, all midfielders). Together with the integration of more sophisticated defensive metrics for the outcome measurement, QCA is a promising way to further assess collective defensive performances. On the other hand, QCA does not calculate probabilities and does not "averaging-out" outliers due to its case-sensitivity. Since football is a 50/50 game of skill and luck (Anderson and Sally 2012), QCA may treat single cases as two important for the outcome. Furthermore should the design of the analysis be improved in order to avoid that players which have been substituted for each other are treated as they would have played together.

There is no doubt that to pinpoint predictions for the world cup would demand to deal with additional factors (e.g. increased physical and psychological stress) that are just partially simulated in the campaign. Such additional factors and the randomness of football that produces uncontrollable situations like injuries, suspensions and lack of game time of players in their clubs demands to treat this analysis, and football analytics in general, with caution. Despite all these shortcomings, such a QCA of collective defensive performance may be a first step to tackle two thorny issues of football: (1) the understudied but crucial defense and (2) the focus on monocausal explanations of collective performances.

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Annex

Table 4: Necessary conditions for good defensive performance (PER) and bad defensive performance (per)

	good defensive performance (PER)		bad defensive performance (per)	
Condition	Consistency	Coverage	Consistency	Coverage
VON BERGEN	0.758	0.665	0.795	0.296
DJOUROU	0.676	0.858	0.402	0.188
SENDEROS	0.252	0.649	0.515	0.488
SCHÄR	0.224	0.729	0.375	0.449
KLOSE	0.266	0.990	0.133	0.182

Table 5: Truth table: Analysis of sufficiency for good defensive performance (PER)

VBE	DJO	SEN	SCH	KLO	Number	PER	Consistency
1	0	0	0	1	1	1	0.991
0	1	0	0	1	1	1	0.989
1	1	0	0	1	1	1	0.987
0	0	1	1	1	1	1	0.985
0	1	1	0	0	2	1	0.945
1	1	0	0	0	9	1	0.848
1	0	1	1	0	1	0	0.837
1	0	0	1	0	3	0	0.699
1	0	1	0	0	1	0	0.598
0	0	1	0	0	1	0	0.534

The raw consistency threshold was set at 0.837. The next highest consistency score is 0.700. No frequency cutoff. Prime implicant is sch*sen.

Conservative solution is identical to the intermediate solution since no directional expectations have been made. Parsimonious solution: DJO+SCH*SEN+KLO+sch*sen → PER (solution consistency 0.869, solution coverage 0.841).

Table 7: Raw data matrix

Game	Von Bergen, Steve (minutes played)	Djourou, Johann (minutes played)	Senderos, Philippe (minutes played)	Schär, Fabian (minutes played)	Klose, Timm (minutes played)	Defensive Performance (Number of goals conceded)
Slovenia Away	92	92	0	0	0	0
Albania Home	92	92	0	0	0	0
Norway Home	92	92	0	0	0	1
Island Away	92	92	0	0	3	0
Cyprus Away	92	53	37	0	0	0
Cyprus Home	92	92	0	0	0	0
Island Home	92	0	0	92	4	4
Norway Away	92	0	3	92	0	0
Albania Away	92	0	0	92	0	1
Slovenia Home	0	92	92	0	0	0
Netherland Away	92	92	0	0	0	0
Luxembourg Away	88	0	0	0	92	0
Argentina Home	0	0	92	0	0	3
Germany Home	92	3	92	0	0	3
Croatia Away	92	92	0	0	0	2
Romania Home	0	92	92	0	0	1
Tunesia Away	22	92	0	0	68	1
Greece Away	74	46	0	0	46	0
Brazil Home	0	0	46	46	92	0
SouthKorea Away	46	0	46	46	0	2
Croatia Home	92	92	0	0	0	2

Table 9: Fuzzy set scores for the games

Game	VBE	DJO	SEN	SCH	KLO	PER
Slovenia Away	0,96	0,96	0,05	0,05	0,05	0,99
Albania Home	0,96	0,96	0,05	0,05	0,05	0,99
Norway Home	0,96	0,96	0,05	0,05	0,05	0,82
Island Away	0,96	0,96	0,05	0,05	0,06	0,99
Cyprus Away	0,96	0,63	0,37	0,05	0,05	0,99
Cyprus Home	0,96	0,96	0,05	0,05	0,05	0,99
Island Home	0,96	0,05	0,05	0,96	0,06	0,02
Norway Away	0,96	0,05	0,06	0,96	0,05	0,99
Albania Away	0,96	0,05	0,05	0,96	0,05	0,82
Slovenia Home	0,05	0,96	0,96	0,05	0,05	0,99
Netherland Away	0,96	0,96	0,05	0,05	0,05	0,99
Luxembourg Away	0,95	0,05	0,05	0,05	0,96	0,99
Argentina Home	0,05	0,05	0,96	0,05	0,05	0,1
Germany Home	0,96	0,06	0,96	0,05	0,05	0,1
Croatia Away	0,96	0,96	0,05	0,05	0,05	0,32
Romania Home	0,05	0,96	0,96	0,05	0,05	0,82
Tunesia Away	0,18	0,96	0,05	0,05	0,82	0,82
Greece Away	0,87	0,52	0,05	0,05	0,52	0,99
Brazil Home	0,05	0,05	0,52	0,52	0,96	0,99
South Korea Away	0,52	0,05	0,52	0,52	0,05	0,32
Croatia Home	0,96	0,96	0,05	0,05	0,05	0,32